

Prevalence and Intensity of *Thelandros magnavulvaris* and *Omeia papillocauda* (Nematoda) in Two Species of Desmognathine Salamanders from West Virginia

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ABSTRACT: Two species of intestinal nematodes are reported from desmognathine salamanders of the Fernow Experimental Forest, Tucker County, West Virginia. *Thelandros magnavulvaris* (Oxyuroidea: Oxyuridae) was recovered from 49.5% of 107 *Desmognathus monticola* and 14.3% of 119 *D. ochrophaeus*, respectively. *Omeia papillocauda* (Seuratoidea: Quimperiidae) was present in 22.4% of the *D. monticola* and 4.2% of the *D. ochrophaeus* individuals sampled. Mean intensities of 1.0 for *T. magnavulvaris* in *D. ochrophaeus* and 2.5 for *O. papillocauda* in *D. monticola* were recorded. Infected individuals of both salamander species were significantly larger than their uninfected counterparts.

KEY WORDS: *Desmognathus monticola*, *Desmognathus ochrophaeus*, salamanders, *Omeia papillocauda*, *Thelandros magnavulvaris*, Nematoda, West Virginia.

Although parasites of desmognathine salamanders have been studied by several investigators, most notably Rankin (1937), Fischthal (1955a, b), Dunbar and Moore (1979), and Baker et al. (1987), little is known about salamander parasites in West Virginia. The purpose of this study, therefore, was to report on the prevalence rates, mean intensities, and sex ratios of nematodes found in West Virginian populations of the Appalachian seal salamander, *Desmognathus monticola* Dunn, and the mountain dusky salamander, *Desmognathus ochrophaeus* Cope.

Materials and Methods

The present study was done in conjunction with an examination of the food preferences of *Desmognathus monticola*, the most aquatic species of this genus in West Virginia, and *Desmognathus ochrophaeus*, a smaller terrestrial species. These salamanders were collected from the Fernow Experimental Forest, which is managed under the auspices of the USDA Forest Service, Northeastern Forest Experiment Station at Parsons, Tucker County, West Virginia.

Totals of 107 *D. monticola* (56 males and 51 females) and 119 *D. ochrophaeus* (62 males and 57 females) were collected from May to October 1989. Salamanders were killed and fixed in 3% formalin, washed in water, and then transferred to 70% ethanol for storage. Each salamander was subsequently measured for snout-vent length and then dissected. Sex was determined for each host individual upon dissection, and then gut contents were examined for nematodes. Nematodes recovered were stored in 70% ethanol. Selected nematode individuals were later dehydrated in an ethanol series, cleared in methyl salicylate, and mounted in Permount®. Nematode species diagnoses were made using the information presented by Rankin (1937), Schad (1963), and Baker et al. (1987). Voucher specimens have been deposited in the U.S. National Parasite Col-

lection (Beltsville, Maryland 20705): *Thelandros magnavulvaris* (82397) and *Omeia papillocauda* (82396).

Because there were no significant differences in *T. magnavulvaris* prevalences between the sexes for either host species ($\chi^2 = 0.009$, $df = 1$, $P > 0.05$ for *D. monticola*, and $\chi^2 = 0.035$, $df = 1$, $P > 0.05$ for *D. ochrophaeus*), infection data on males and females for both host species were combined. Prevalences of *O. papillocauda* were considered too low for a reliable Chi-square analysis between host sexes.

Results

Thelandros magnavulvaris (Rankin, 1937) Schad, 1960, and *Omeia papillocauda* Rankin, 1937, were recovered from the intestines of *Desmognathus monticola* and *D. ochrophaeus* collected at the Fernow Experimental Forest, West Virginia, in 1989. Prevalences and intensity of infections are shown in Table 1. While 14 *D. monticola* harbored dual infections, none of the *D. ochrophaeus* was found infected concurrently with both nematode species (Tables 2, 3).

Statistical comparisons of mean intensities between the 2 host species were not made because of the relatively small number of nematodes (only 27) recovered from *D. ochrophaeus*. In *D. monticola*, where suitable numbers of nematodes were available, there was no statistical difference in the mean intensity levels between *T. magnavulvaris* and *O. papillocauda* (Table 1).

Host length was an important indicator of infection, since infected individuals in both host species were significantly larger than their uninfected counterparts (Tables 2, 3).

All 139 *T. magnavulvaris* recovered from both host species were females. Of the 70 *O. papil-*

Table 1. Prevalence and mean intensity of *Thelandros magnavulvaris* (T) and *Omeia papillocauda* (O) in *Desmognathus monticola* and *Desmognathus ochrophaeus* from the Fernow Experimental Forest.

<i>Desmognathus monticola</i>				<i>Desmognathus ochrophaeus</i>			
Prevalence		Intensity ($\bar{x} \pm 1$ SD)		Prevalence		Intensity ($\bar{x} \pm 1$ SD)	
T	O	T	O	T	O	T	O
53/107*	24/107†	2.3 \pm 1.4‡	2.5 \pm 1.9‡	17/119*	5/119†	1.0 \pm 0	2.0 \pm 0.7

* $\chi^2 = 31.11$, $df = 1$, $P < 0.05$.
† $\chi^2 = 15.15$, $df = 1$, $P < 0.05$.
‡ $t = 0.515$, $df = 75$, $P > 0.05$.

locauda recovered from both host species, only 6 were males for a male : female sex ratio of 1:11.7.

Discussion

Prevalences of *Thelandros magnavulvaris* in *D. monticola* (49.5%) and *D. ochrophaeus* (14.3%) from West Virginia (Table 1) compared favorably to the 46.5 and 13.9% reported by Dunbar and Moore (1979) for the same 2 host species, respectively, from Tennessee. Thus, we are in agreement with Dunbar and Moore that the more aquatic salamanders (i.e., *D. monticola*) are far more likely to be infected with *T. magnavulvaris*. There is one other record of *T. magnavulvaris* from West Virginia (at Cooper’s Rock, some 65 km north of the present study site) (Schad, 1963). Here, 6 of 25 (24.0%) green salamanders, *Aneides aeneus*, were infected by this oxyuroid. Rankin (1937) noted “large numbers” of these female oxyuroids from desmognathine, and other salamander species from North Carolina, but did not cite specific numbers of infected versus uninfected hosts. Conversely, *T. magnavulvaris* was not mentioned in a more recent study of des-

mognathine salamanders from North Carolina (Baker et al., 1987), nor was this oxyuroid found in a sample of 57 northern dusky salamanders, *Desmognathus fuscus*, from New York (Fischthal, 1955b). Eighteen of 178 *D. fuscus* from Pennsylvania were, however, infected by *T. magnavulvaris* (Fischthal, 1955a), as were 119 of 442 *D. fuscus* from Illinois (Dyer et al., 1980) and 48 of 171 red-backed salamanders, *Plethodon cinereus*, from Michigan (Muzzall, 1990). Only Dyer et al. (1980) segregated male from female hosts for the purpose of comparing prevalences between the sexes. A Chi-square value, calculated from their Table 1, showed no significant difference in the *T. magnavulvaris* prevalences between male and female *D. fuscus* (i.e., $\chi^2 = 1.47$, $df = 1$, $P > 0.05$), a finding compatible with our observations.

In the present study *Omeia papillocauda* was recovered from 22.4 and 4.2% of the *D. monticola* and *D. ochrophaeus* examined, respectively (Table 1). While Baker et al. (1987) cited a higher prevalence (8.4%) for this seuratoid from *D. ochrophaeus*, their recorded prevalence of 20.0% for *D. monticola* was comparable to that found at Fernow. Dunbar and Moore (1979) found no *O.*

Table 2. Snout-vent lengths (SVLs; in millimeters) for infected and uninfected *Desmognathus monticola* individuals. Mean SVL based on sample number given in n_a . SVL not available for some individuals in host sample (n_b).

	<i>Thelandros magnavulvaris</i> infected	<i>Omeia papillocauda</i> infected	Dual infections	Uninfected
n_a	33	9	12	38
n_b	6	1	2	6
Mean SVL		52.9*†		44.8*

* $t = 3.75$, $df = 90$, $P < 0.05$.
† Calculated for entire n_a sample of 54.

Table 3. Snout-vent lengths (SVLs; in millimeters) for infected and uninfected *Desmognathus ochrophaeus* individuals. Mean SVL based on sample number n .

	<i>Thelandros magnavulvaris</i> infected	<i>Omeia papillocauda</i> infected	Dual infections	Uninfected
n	17	5	0	97
Mean SVL		35.9*†		34.2*

* $t = 2.26$, $df = 117$, $P < 0.05$.
† Calculated for the entire n sample of 22.

papillocauda (= *O. chickasawi*) in 36 *D. ochrophaeus*, but 17 of 43 (39.5%) *D. monticola* were infected, the highest verifiable prevalence recorded to date for this seuratoid.

Mean intensity of *T. magnavulvaris* infections in salamanders is characteristically low. Schad (1963) recovered 18 *T. magnavulvaris* from 6 infected green salamanders, while Fischthal (1955a) and Muzzall (1990) recorded mean intensities of 1.6 and 1.9 for their respective host samples. Thus, the mean of 2.3 for *D. monticola* in the present study (Table 1) cannot be considered unusual. No previous data are available for mean intensity of *O. papillocauda* infections. In the present study, there were no significant differences in mean intensity levels between *T. magnavulvaris* and *O. papillocauda* in *D. monticola* (Table 1).

All 139 *T. magnavulvaris* recovered from salamanders in this study were females. The recovery of only females for this nematode species is nearly universal (Rankin, 1937; Walton, 1940; Fischthal, 1955a; Dyer and Peck, 1975; Dunbar and Moore, 1979). Males are known, however, since Schad (1963) redescribed this oxyuroid species on the basis of 5 females and 5 males and Dyer et al. (1980) recovered 5 males from 442 *D. fuscus* in Illinois. Muzzall (1990) added that "... female *T. magnavulvaris* were much more common than males in red-backed salamanders." *Omeia papillocauda* populations in the present study were also heavily female-biased, with a female: male sex ratio of 11.7:1.0. While previous investigators have recovered males of *O. papillocauda* (Rankin, 1937; Walton, 1940; Baker et al., 1987), precise sex ratios for this species are not cited by those investigators.

Infected individuals, of both host species, are significantly larger than their uninfected counterparts (Tables 2, 3). The reasons for this are not clear. For example, it is easy to conclude, in the case of *D. monticola*, that larger host individuals with their larger intestinal tracts, provide more habitat for these relatively large nematodes. That argument, however, is weakened

considerably when one considers that the smaller, uninfected *D. monticola* individuals are still considerably larger than the infected *D. ochrophaeus* hosts. This added to the fact that dual infections occurred in *D. monticola* but not in *D. ochrophaeus* demonstrates that the infection dynamics between these nematode species and their desmognathine hosts are still not clearly understood.

Literature Cited

- Baker, M. R., T. M. Goater, and G. W. Esch. 1987. Descriptions of three nematode parasites of salamanders (Plethodontidae: Desmognathinae) from the southeastern United States. *Proceedings of the Helminthological Society of Washington* 54:15-23.
- Dunbar, J. R., and J. D. Moore. 1979. Correlations of host specificity with host habitat in helminths parasitizing the plethodontids of Washington County, Tennessee. *Journal of the Tennessee Academy of Science* 54:106-109.
- Dyer, W. G., R. A. Brandon, and R. L. Price. 1980. Gastrointestinal helminths in relation to sex and age of *Desmognathus fuscus* (Green, 1818) from Illinois. *Proceedings of the Helminthological Society of Washington* 47:95-99.
- , and S. B. Peck. 1975. Gastrointestinal parasites of the cave salamander, *Eurycea lucifuga* Rafinesque, from the southeastern United States. *Canadian Journal of Zoology* 53:52-54.
- Fischthal, J. H. 1955a. Ecology of worm parasites in southcentral New York salamanders. *American Midland Naturalist* 53:176-183.
- . 1955b. Helminths of salamanders from Promised Land State Forest Park, Pennsylvania. *Proceedings of the Helminthological Society of Washington* 22:46-48.
- Muzzall, P. M. 1990. Endoparasites of the red-backed salamander, *Plethodon c. cinereus*, from southwest Michigan. *Proceedings of the Helminthological Society of Washington* 57:165-167.
- Rankin, J. S. 1937. New helminths from North Carolina salamanders. *Journal of Parasitology* 23:29-42.
- Schad, G. A. 1963. *Thelandros magnavulvaris* (Rankin, 1937) Schad, 1960 (Nematoda: Oxyuroidea) from the green salamander, *Aneides aeneus*. *Canadian Journal of Zoology* 41:493-496.
- Walton, A. C. 1940. Some nematodes from Tennessee amphibia. *Journal of the Tennessee Academy of Science* 15:402-405.